RHODORA, Vol. 93, No. 873, pp. 51–66, 1991

# THE IDENTITY OF *CAREX ALBOLUTESCENS*, *C. FESTUCACEA*, AND *C. LONGII* (CYPERACEAE)

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## ABSTRACT

*Carex albolutescens* and *C. longii* (section *Ovales*) are considered conspecific by some authors. A survey of herbarium material revealed that they are morphologically distinct and simply represent a misapplication of species names. On the other hand, *C. albolutescens* is easily confused with a third species, *C. festucacea*. Diagnostic characters useful in identifying these three species are reviewed and new ones suggested. A species key and descriptions are provided.

Key Words: *Carex albolutescens*, *C. festucacea*, *C. longii*, section *Ovales*, Cyperaceae, North America

## INTRODUCTION

Species of *Carex* L. from section *Ovales* (Kunth) Christ deserve a reputation for difficulty in their identification. Typically, a successful understanding of the species requires close attention to mature perigynia to perceive subtle differences in shape, color, and texture. Confusion over this sedge group in the nineteenth century was so great that one exasperated botanist, in trying to apply a taxonomy formulated by S. T. Olney, scrawled across an herbarium sheet "since Olney has manipulated them, it's not for ordinary mortal to name them."

Mackenzie's (1931) monograph of North American *Carex* culminated a long series of papers by himself, Bailey, Fernald, and others dealing with the taxonomy and nomenclature of section *Ovales*. His treatment brought order to the group and has been largely incorporated in eastern North American regional floras. However, at least one species in Mackenzie's monograph remained improperly typified. Upon reexamination of the type for *C. straminea* Willdenow *ex* Schkuhr, Svenson (1938) discovered that the name *C. straminea* should be applied to *C. richii* (Fernald) Mackenzie. This change, in turn, required the name *C. albolutescens* Schweinitz be revived for the taxon treated as *C. straminea* by Mackenzie.

Since Svenson's correction of nomenclature, regional floras have contained conflicting classifications of *Carex albolutescens* and *C. longii* Mackenzie. Several floras, notably those of Gleason (1952), Radford et al. (1964), and Seymour (1969), reduced *C.*

*longii* to synonymy with *C. albolutescens*. On the other hand, floras by Fernald (1950) and Voss (1972) maintained that two distinct species may be recognized. The present study was initially undertaken to clarify the taxonomy of *C. longii*. While reviewing herbarium material from the southeastern United States, the heart of the geographical range of *C. albolutescens*, it became apparent that part of the disagreement stems from confusion between *C. albolutescens* and a third taxon, *C. festucacea* Schkuhr *ex* Willdenow. As a result, true *C. longii* is recorded as *C. albolutescens* while true *C. albolutescens* is cataloged with *C. festucacea*. This paper reviews the diagnostic characters used currently in regional manuals, seeks additional characters of diagnostic value, and reviews the nomenclature of each of these species.

## MATERIALS AND METHODS

This study was based on over 700 specimens of *Carex* from the following herbaria: BH, CU, GA, GH, IND, MICH, MO, NCU, NY, PAC, PH, SIU, TENN, and VPI. A sample of ninety-seven specimens was scored for 7 qualitative and 34 quantitative characters. The characters studied included but were not limited to those used by recent authors. Eight characters were derived from freehand, midculm cross-sections. Characters of perigynia, achenes, and pistillate scales were measured at 30× magnification. The base of the perigynium beak was estimated as the point at which margin curvature deflects towards the beak tip. All references to the width and shape of perigynium include the thin, winged margin. After rejecting four quantitative characters on the basis of likely genetic redundancy, principal components analysis (PCA) was applied to 30 quantitative characters (Table 1) using NTSYS-PC (Rohlf, 1987). The F-statistic of ANOVA also aided in discerning which quantitative characters are of greatest value in delimiting morphological boundaries. Holotypes of *Carex albolutescens* and *C. longii* were examined to verify use of these names. Since the type of *C. festucacea* is apparently lost (A. A. Reznicek, pers. comm.), Schkuhr's (1801) illustration of his holotype was consulted to determine the application of the name.

## RESULTS AND DISCUSSION

Section *Ovales* is the largest North American section in the genus *Carex*. Species in this group have gynaecandrous spikes,

Table 1. List of characters subjected to principal components analysis.

1. Mature culm height
2. Longest leaf sheath length/culm height
3. Length of ventral hyaline band
4. Culm diameter
5. Culm wall thickness
6. Number of culm lacunae
7. Number of culm vascular bundles
8. Radial thickness of largest culm fiber bundle
9. Tangential thickness of largest culm fiber bundle
10. Anticlinal length of culm epidermal cell
11. Periclinal length of culm epidermal cell
12. Inflorescence length
13. Number of spikes
14. Length of female portion of lateral spike
15. Length of male portion of lateral spike
16. Width of lateral spike
17. Length of perigynium body
18. Width of perigynium
19. Perigynium length from widest point
20. Beak length
21. Midbeak width
22. Length of serrulate margin/length of perigynium
23. Length of dorsal beak suture
24. Length of ventral beak suture
25. Number of dorsal perigynial nerves
26. Number of ventral perigynial nerves
27. Achene length/width
28. Achene width
29. Achene length from widest point
30. Style: amplitude of lateral sinuosity

wing-margined perigynia and hollow culms. Mackenzie (1931) placed *C. albolutescens* and *C. longii* in subsection *Alatae* within *Ovales* because they both have obovate perigynium bodies and strong ventral nerves on the leaf sheaths. Members of *Alatae* also tend to have relatively slender achenes. Subsection *Alatae* seems to be a natural grouping in North America which includes *C. alata, C. cumulata,* and *C. silicea. Carex festucacea* is classified in subsection *Festucaceae,* characterized by perigynia widest near or below the middle. Other members of this subsection include *C. molesta, C. normalis,* and *C. tenera. Carex festucacea,* according to Mackenzie, may be further distinguished by its combination of suborbicular perigynium bodies, long beaks, and moniliform inflorescences. *Carex albolutescens* and *C. longii,* on the

other hand, are recognized by Mackenzie on the basis of the color and density of inflorescence, shape of perigynium beak, apex of pistillate scales, and thickness of culm.

## Typification

The holotype for *Carex albolutescens,* deposited at PH, is a collection by Rev. Schweinitz labeled as "Nobis junior lagopod" from Salem [North Carolina] and Bethlehem [Pennsylvania]. The type locality cannot be determined more precisely since both Moravian towns were undoubtedly visited by Schweinitz and both are within the known range of this species. Although collected at the immature fruiting stage, *C. albolutescens* may be characterized as a slender plant which clearly has obovate perigynia with narrow beaks, acute-tipped pistillate scales, and short inflorescences. The holotype for *C. longii,* also on deposit at PH, is a collection by B. Long from Cape May County, New Jersey on 24 July 1907. In contrast to *C. albolutescens, C. longii* displays broad beaked obovate perigynia and obtuse pistillate scales. In addition, spikes of this specimen are congested with appressed-ascending perigynium beaks rather than spreading beaks. Achenes are oblong, less than 1 mm wide, and bear straight styles. Schkuhr's illustration of the holotype for *C. festucacea* depicts a plant with some anthesis of male flowers. Schkuhr's plant had perigynia with narrow beaks and very acute-tipped pistillate scales, much like *C. albolutescens.* On the other hand, at least three characters associated with *C. festucacea* are clearly depicted: oval shape of the perigynium body; long tapered bases of lateral spikes; and a long inflorescence. Also, Schkuhr illustrated the achene as somewhat ovoid with a straight style. Unfortunately, he only provided a dorsal view of the perigynium, so that the nervation of the ventral face is in doubt. Nonetheless, the illustration clearly represents *C. festucacea* as interpreted here, and serves to fix the application of the name.

## General Character Analysis

Both quantitative and qualitative characters distinguish these three taxa at the species level. Vegetative as well as reproductive characters may be of value in species recognition; clearly, however, mature reproductive characters are of most use.

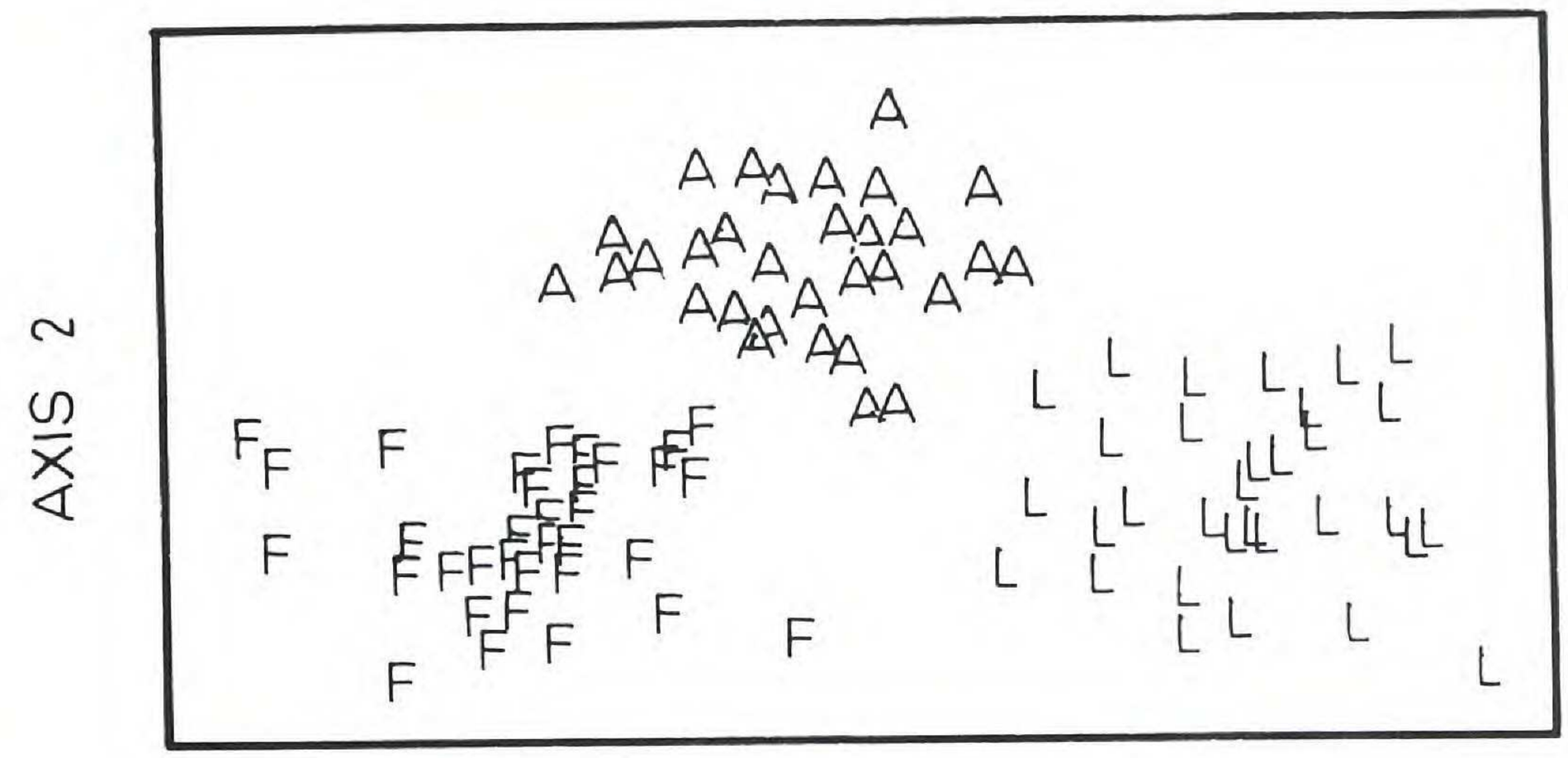



Figure 1. Ordination of *Carex albolutescens* (A), *C. festucacea* (F), and *C. longii* (L) along principal components axes 1 and 2. Axis 1 accounts for 20% of the total variation, while axis 2 accounts for 11%.

Principal components analysis of 30 quantitative characters shows three clusters of points which correspond to the three species typified above (Figure 1). The first component, accounting for 20% of the total variation, clearly separates *Carex festucacea* from *C. longii* and, to large degree, *C. albolutescens* from *C. longii*. There is overlap of *C. albolutescens* and *C. festucacea* in the first component. The second component, with a few exceptions, separates *C. albolutescens* from *C. festucacea* and *C. longii*. The second component explains 11% of the total variation in the data. An additional 8% of total variation is contained within the third principal component. However, this vector displays no separation into species groupings. The characters which show the greatest weighting in the first principal component (Table 2) include perigynium length from base to widest point, midbeak width, length of perigynium body, length of male portion of spikes, and achene length/width ratio. The greatest weightings in the second principal component include amount of style sinuosity and features of culm anatomy. These anatomical features include radial and tangential thickness of culm fiber bundles as well as anticlinal and periclinal length of epidermal cells adjacent to fiber bundles.

Of the 30 quantitative characters analyzed, 17 yielded F-ratios greater than 10 when subjected to ANOVA (Table 2). Among the highest F-ratios was 137.7 for midbeak width, demonstrating that

Table 2. Mean, interquartile range, eigenvalue and F-ratio for 17 quantitative characters distinguishing *C. albolutescens* (A), *C. festucacea* (F), and *C. longii* (L). Eigenvalues from axis two are marked **; all others are from axis one. F-ratios are significant at a level of less than 0.001.

| Character | | Mean | Interquartile Range | Eigen-value | F-Ratio |
|---|---|---|---|---|---|
| Leaf sheath length vs. mature culm height ratio | A | 0.36 | 0.29–0.39 | 0.44 | 10.6 |
| | F | 0.30 | 0.23–0.37 | | |
| | L | 0.40 | 0.34–0.46 | | |
| Culm epidermal cell length (anticlinal) (μm) | A | 4.7 μm | 3.3–5.6 | −0.52 | 47.5 |
| | F | 5.4 | 4.4–5.6 | ** | |
| | L | 7.5 | 6.7–8.9 | | |
| Culm epidermal cell length (periclinal) (μm) | A | 9.0 μm | 7.8–10.0 | −0.65 | 25.1 |
| | F | 10.5 | 8.9–11.1 | ** | |
| | L | 12.2 | 11.1–13.3 | | |
| Radial thickness of largest culm fiber bundle (μm) | A | 40.2 μm | 34.4–45.6 | −0.71 | 17.4 |
| | F | 55.9 | 50.0–61.3 | ** | |
| | L | 54.2 | 42.5–64.4 | | |
| Tangential thickness of largest culm fiber bundle (μm) | A | 86.6 μm | 75.0–97.5 | −0.61 | 12.3 |
| | F | 112.5 | 100.0–125.0 | ** | |
| | L | 97.9 | 79.4–113.8 | | |
| Inflorescence length (mm) | A | 29.6 mm | 25.1–33.9 | −0.49 | 19.3 |
| | F | 39.6 | 32.0–47.5 | | |
| | L | 29.7 | 26.3–34.6 | | |
| Number of spikes per inflorescence | A | 4.7 | 4.0–5.5 | −0.41 | 10.2 |
| | F | 5.7 | 5.0–6.0 | ** | |
| | L | 5.7 | 5.0–6.1 | | |
| Spike length: male portion (mm) | A | 3.4 mm | 2.5–3.9 | −0.70 | 39.3 |
| | F | 4.4 | 3.0–6.1 | | |
| | L | 1.6 | 1.0–2.0 | | |
| Spike length: female portion (mm) | A | 6.2 mm | 5.8–6.9 | 0.51 | 19.8 |
| | F | 6.2 | 5.9–7.0 | | |
| | L | 7.8 | 7.2–8.6 | | |
| Perigynium body length (mm) | A | 2.2 mm | 2.1–2.4 | 0.70 | 30.5 |
| | F | 2.1 | 1.9–2.2 | | |
| | L | 2.6 | 2.3–2.8 | | |
| Perigynium width (mm) | A | 2.1 mm | 1.9–2.3 | 0.47 | 15.7 |
| | F | 1.9 | 1.7–2.0 | | |
| | L | 2.2 | 2.0–2.3 | | |
| Perigynium length from base to widest point (mm) | A | 1.5 mm | 1.3–1.6 | 0.84 | 85.2 |
| | F | 1.1 | 1.0–1.2 | | |
| | L | 1.7 | 1.6–1.9 | | |

Table 2. Continued.

| Character | | Mean | Interquartile Range | Eigen-value | F-Ratio |
|---|---|---|---|---|---|
| Midbeak width (mm) | A | 0.31 mm | 0.25–0.35 | 0.77 | 137.7 |
| | F | 0.32 | 0.30–0.35 | | |
| | L | 0.56 | 0.50–0.60 | | |
| Number of ventral nerves | A | 4.7 | 4.0–5.0 | 0.52 | 24.9 |
| | F | 2.9 | 2.0–4.0 | | |
| | L | 4.9 | 4.0–6.0 | | |
| Achene length/width ratio [length excludes style base] | A | 1.67 | 1.59–1.76 | 0.62 | 35.3 |
| | F | 1.40 | 1.28–1.50 | | |
| | L | 1.71 | 1.55–1.87 | | |
| Achene width (mm) | A | 0.90 mm | 0.85–0.95 | −0.53 | 40.1 |
| | F | 1.03 | 1.00–1.10 | | |
| | L | 0.90 | 0.85–0.96 | | |
| Style: amplitude of lateral sinuosity (mm) | A | 0.23 mm | 0.17–0.25 | 0.80 | 201.5 |
| | F | 0.03 | 0.00–0.05 | ** | |
| | L | 0.02 | 0.00–0.05 | | |

beaks of *Carex longii* are wide ($\bar{x}$ = .56 mm) compared to those of *C. albolutescens* and *C. festucacea* ($\bar{x}$ = .31 and .32). A second character with a high F-ratio of 85.2 was perigynium length from base to widest point. *Carex festucacea,* with its oval rather than obovate body, had the smallest length ($\bar{x}$ = 1.1 mm). Other vegetative and inflorescence characters with significant F-ratios are detailed below.

LEAVES AND CULMS. All three species have a similar caespitose habit and similar range of leaf widths. *Carex festucacea* has the shortest leaf sheath relative to the length of mature culms (Table 2); *C. festucacea* has a mean ratio of only .30, compared to .36 for *C. albolutescens* and .40 for *C. longii.* In evaluating this character, only fully mature culms can be used since culms continue to increase in length during fruit ripening.

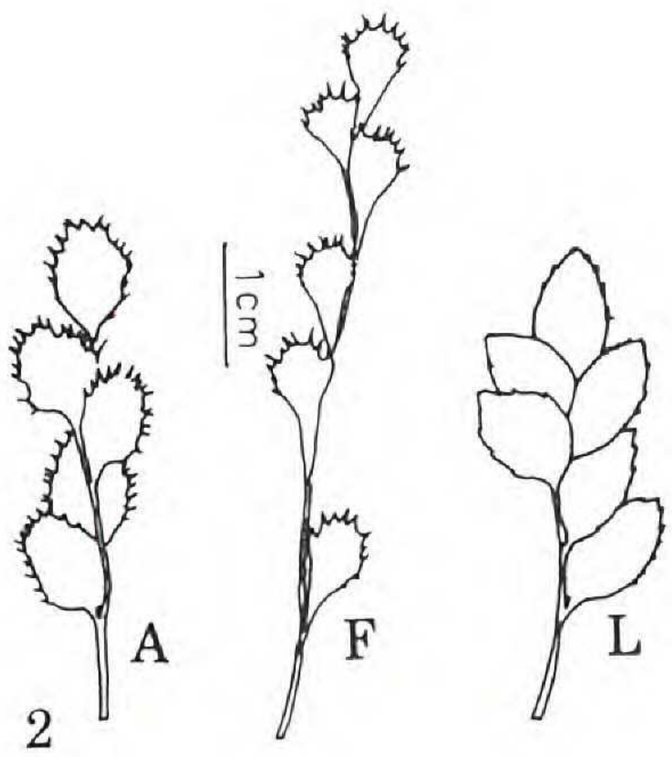
Mackenzie (1931) maintained that the ventral hyaline band of the leaf sheath of *Carex festucacea* can be a useful diagnostic character. If indeed this character is diagnostic, it is difficult to interpret. In most specimens of *C. festucacea,* a thin hyaline area with fine veins occurs ventrally near the mouth of the sheath and usually becomes indistinct several mm below that region. Some leaf sheaths of *C. albolutescens* and *C. longii* may have identical

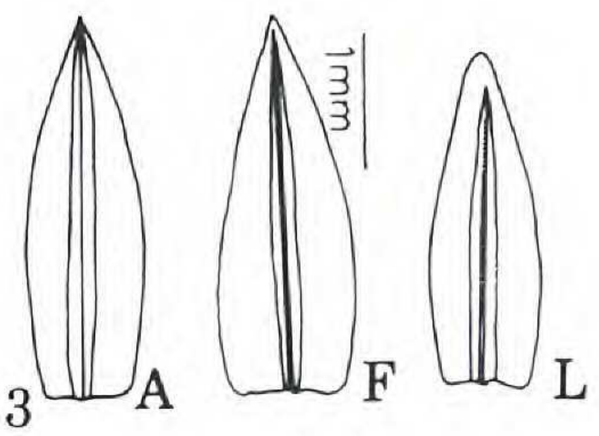
hyaline areas, while other leaf sheaths of these species maintain strong venation to near the mouth of the sheath and have a distinct boundary between hyaline and non-hyaline areas.

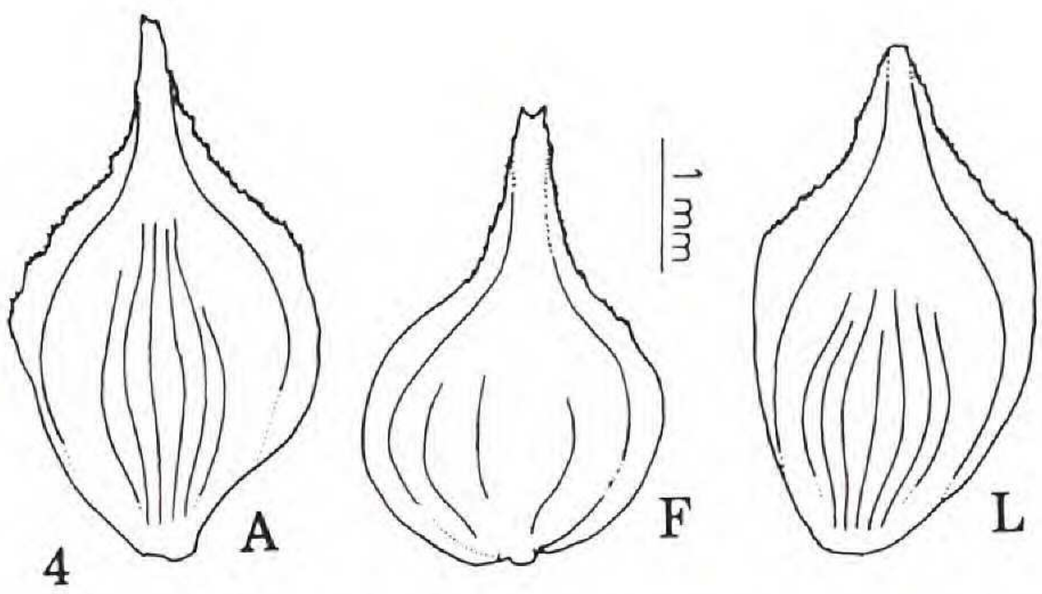
Both Mackenzie (1931) and Fernald (1950) described some difference in culm stiffness. In attempting to quantify this difference, midculm diameter, wall thickness, and the cross sectional thickness of fiber bundles were assessed. Midculm thickness and thickness of the wall had only slight if any statistical difference in the three species. The radial thickness of fiber bundles did vary strongly between taxa (F = 17.4, Table 2). *Carex albolutescens* had the least fiber development with a mean of 40.2 μm as compared with means of greater than 54 μm for both *C. longii* and *C. festucacea.* In addition to the differing degrees of fiber development, culm cross-sections revealed a size differential in epidermal cells lying adjacent to fiber bundles; of the three species, *C. longii* had the largest cells with an average anticlinal length of 7.5 μm and periclinal length of 12.2 μm. *Carex albolutescens* had much smaller epidermal cell lacunae ($\bar{x}$ = 4.7 × 9.0 μm), while *C. festucacea* was intermediate ($\bar{x}$ = 5.4 × 10.5 μm).

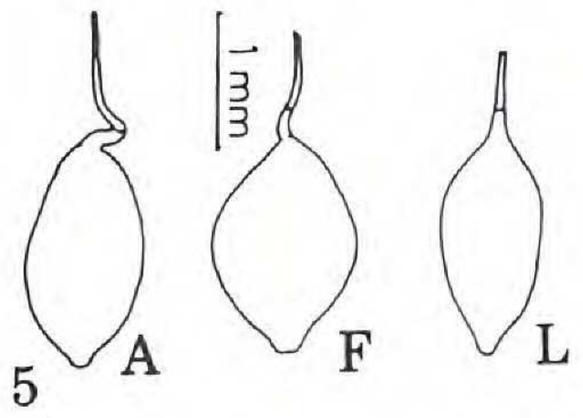
INFLORESCENCE AND SPIKE. As shown in Table 2, inflorescence length differs significantly among the three species (F = 19.3); inflorescences of *Carex festucacea* are longest, typically greater than 3.0 cm. In addition to this greater inflorescence length, spikes of this species frequently have long tapered bases bearing numerous male flowers and rounded apices formed by spreading perigynium beaks (Table 3, Figure 2). In contrast, inflorescences of *C. albolutescens* seldom reach more than 3.0 cm in length. Their spikes have acute to sometimes long tapering bases and are rounded apically. For this reason they may be easily confused with those of *C. festucacea.* The inflorescences of *C. longii* occasionally reach the length of 3.5 cm or more, within the range of variation present in *C. festucacea.* The congestion and shape of spikes of *C. longii* are singular. *Carex longii* spikes exhibit rounded bases and, most importantly, seldom have spreading perigynium beaks. As a result of the ascending, appressed beaks, the spikes frequently have an acute to obtuse apex (Figure 2).

Pistillate scale apices of *Carex longii* (Figure 4) are bluntish in contrast to the sharply acute apices of *C. albolutescens* (Voss, 1972). A survey of a large number of specimens showed this observation to be constant. Its application may at times be limited




Figures 2–5. **2.** Inflorescences, **3.** Perigynia, **4.** Pistillate scales, and **5.** Achenes of *C. albolutescens* (A), *C. festucacea* (F), and *C. longii* (L).

by having frayed or curled scales or by failure to recognize that scales near the spike apex tend to be more acute. The pistillate scales of *C. albolutescens* and *C. festucacea* are similar in size, shape, and apex. Their acute tips are flat, rather than convex as in *C. longii,* with the midrib usually reaching to the very tip of the scale.

PERIGYNIA. Perigynia possess a number of traits of diagnostic value. The perigynium body length of *Carex festucacea* perigynia tends to be the shortest of the three species, typically 1.9–2.2 mm (Table 2). The body length in *C. albolutescens* and *C. longii* is seldom below 2.1 mm. In addition to size differences, *C. festucacea* perigynia have more oval to orbicular bodies (Figure 3). The widest point is ca. 1.1 mm from the base in contrast to 1.5 mm for *C. albolutescens* and 1.7 mm for *C. longii.*

Fernald (1950) described the beak of *Carex longii* as broad, triangular and gradually tapering into the body (Figure 3). Beaks of *C. albolutescens* and *C. festucacea* tend to be narrower (mean midbeak width ca. .3 mm) and arise more abruptly from the body.

Table 3. Qualitative characters distinguishing *C. albolutescens* (A), *C. festucacea* (F), and *C. longii* (L).

| Character | | Description |
|---|---|---|
| Spike arrangement | A | approximate, not congested |
| | F | separated |
| | L | frequently congested |
| Lateral spike base | A | acute or tapered; sometimes rounded |
| | F | acute to long tapered |
| | L | rounded; sometimes acute |
| Spike apex | A | rounded, beaks spreading |
| | F | rounded, beaks spreading |
| | L | obtuse to acute, beaks appressed-ascending |
| Pistillate scale | A | flat, apex acute, midrib to tip |
| | F | flat, apex acute, midrib usually to tip |
| | L | usually convex with flat margins, apex obtuse, midrib ending short of tip |
| Perigynial body [includes winged margin] | A | obovate |
| | F | orbicular to oval |
| | L | obovate |
| Mature perigynium color | A | straw colored |
| | F | straw colored |
| | L | brown |
| Perigynial beak | A | narrow, wing ending 0.2–0.4 mm below apex |
| | F | narrow, wing ending 0.2–0.4 mm below apex |
| | L | broad, ± winged to apex |
| Style | A | strongly sinuous laterally |
| | F | straight or bent dorsiventrally |
| | L | straight |

The wing margins of these beaks end approximately .2 mm short of the beak apex. Quantification of these characters confirmed that they are highly significant statistically (Table 2). Although differences in beak shape hold throughout the range of these species, a noteworthy geographical variation occurs in inland populations of *C. longii,* which frequently have smaller perigynia and correspondingly narrower beaks.

Other perigynium characters are also helpful in species distinction. In *Carex longii,* the perigynia can take on a dull brown color as they mature, while those of the other two species mature into a bronze-tinged straw color. Finally, the perigynia of *C. festucacea* seem to have a textural difference in that they tend to be more coriaceous and on average have 3 or fewer strong ventral


Figure 6. Distribution of *C. albolutescens* (A), *C. festucacea* (F), and *C. longii* (L) in eastern United States and Canada.

nerves. *Carex albolutescens* and *C. longii* generally have 4 to 7 distinctly raised ventral nerves.

ACHENE AND STYLE. Morphology of the achene and style has apparently not been previously studied in these three species. Achenes of *C. festucacea* are significantly wider (F = 40.1, Table 2), with an interquartile range of 1.00–1.10 mm. Achenes of *C. albolutescens* and *C. longii* seldom reach more than .95 mm in width and exhibit an oblong shape compared to more ovoid achenes of *C. festucacea* (Table 2).

Variation in style form is even more striking. Styles observed in *Carex albolutescens* show a strong lateral deflection or sinuosity of ca. .2 mm (Table 2, Figure 5) rather than the straight form in *C. longii*. *Carex festucacea* styles vary from straight to dorsiventrally bent at the base. None have the degree of sinuosity typical of *C. albolutescens* as evidenced by the high F-ratio of 201.5 for this character (Table 2).

DISTRIBUTION AND HABITAT. According to herbarium records, all three *Carex* species broadly overlap in their ranges and habitat requirements. *Carex albolutescens* has its greatest frequency in moist, acidic woodland soils of the Piedmont, especially in the Carolinas (Figure 6). It also occurs sporadically inland as far west as Lake Michigan and into parts of the Mississippi Valley. *Carex longii* (Figure 6) is the most common and widespread of these species, thriving in seasonally wet, sandy soils of the Coastal Plain from Texas north to Massachusetts and southern Nova Scotia. Sporadic inland stations are known as far west as Illinois and Arkansas. It also is reported from mountainous areas of Mexico, Central America, and western South America as well as from

Bermuda and Haiti. Recently it has been introduced into Hawaii. In North America, *C. longii* seems to favor less shaded habitats than either *C. albolutescens* or *C. festucacea*. *Carex festucacea* (Figure 6) is most frequently found from eastern Pennsylvania to western Missouri, with its range extending into southern Ontario and as far south as the Gulf states. It prefers moist, open woods or brush and soils with less sand content than typical for *C. albolutescens* and *C. longii*.

KEY TO THE SPECIES

1. Perigynium bodies oval or orbicular, often with 3 or fewer nerves ventrally; mature achenes 1.0 mm or more wide and styles straight or bent dorsiventrally; inflorescences usually greater than 3.0 cm long, spikes separated and long tapered at base ..... *C. festucacea*
1. Perigynium bodies obovate, typically with 4 to 7 ventral nerves; mature achenes less than .95 mm wide and styles straight or with strong lateral sinuosity; inflorescences usually less than 3.0 cm long, spikes of longer inflorescences congested and rounded at base ..... 2
2. Beaks of perigynia broad (midbeak width ca. .5 mm), appressed-ascending, winged margins extending to apex of beak; pistillate scales with obtuse apex, convex, midrib ending short of tip; styles straight ..... *C. longii*
2. Beaks of perigynia slender (midbeak width usually < .35 mm), spreading, winged margins ending ca. .2 mm below apex of beak; pistillate scales with acute apex, flat, midrib reaching to tip; styles laterally sinuous ..... *C. albolutescens*

SPECIES DESCRIPTIONS

1. **Carex albolutescens** Schweinitz, Ann. Lyceum Nat. Hist. N.Y. 1:66. 1824. TYPE: Salem and Bethl. [N.C. and Pa.]. "Nobis junior lagopod." Ex herbarium Schweinitz (HOLOTYPE: PH!).

Culms caespitose. Fertile culms 2.5–12 dm tall; culm bases pale to brownish-black, 1.0–2.5 mm thick; aphyllopodic. Longest leaf sheaths ¼ to about ½ as long as mature culms. Ligules prolonged, often somewhat loose. Leaves 3–5 to a fertile culm; broadest leaves 2–3.5 mm wide; upper blades 5–25 cm long. Inflorescences

1.5–4.0 cm (rarely longer) and composed of 2–8, usually approximate, gynaecandrous spikes with spreading beaks. Lowest bracts scale-like to setaceous. Spikes 5–13 × 4–6.5 mm, rounded at apex, acute to tapered at base. Pistillate scales shorter and narrower than perigynia, flat with acute apex. Perigynia papery, green to straw colored at maturity, 2.6–4.5 × 1.5–2.7 mm, the body obovate with 4–7 raised nerves on ventral face and many nerves on dorsal face. Perigynium beaks ⅓ to ¾ as long as body, abruptly tapered from body, narrow with wing ending below apex. Body of achenes 1.3–1.7 mm long and .75–1 mm wide, oblong. Styles strongly bent or sinuous laterally.

As demonstrated by Svenson (1938), the name *Carex straminea* was erroneously applied to this species by Mackenzie (1922, 1931). Gleason (1952) and Radford et al. (1964) treated this taxon as conspecific with *C. festucacea.*

2. **Carex festucacea** Schkuhr *ex* Willdenow, Sp. Pl. 4: 242. 1805. TYPE: Habitat in America boreali.

Culms caespitose. Fertile culms 4.5–10 dm tall; culm bases brownish-black, 1.5–2.5 mm thick, aphyllopodic. Longest leaf sheaths ⅙ to ⅖ as long as mature culm. Ligules prolonged and generally tight. Leaves 3–5 to a fertile culm; broadest leaves 1–5 mm wide; upper blades 5–30 cm long. Inflorescences 2.5–6 cm long and composed of 3–10 usually separated, gynaecandrous spikes with spreading beaks. Lowest bracts scale-like to setaceous. Spikes 6–16 × 5–6.5 mm, rounded at apex, acute to long tapered at base. Pistillate scales shorter and narrower than perigynia, flat with acute to acuminate apex. Perigynia subcoriaceous, green to straw colored at maturity, 2.5–3.5 × 1.5–2.2 mm, the body orbicular to oval with 2–4 usually short and inconspicuous nerves on the ventral face and many nerves on dorsal face. Perigynium beaks ⅓ to ¾ as long as body, abruptly tapered from body, narrow with wing ending below apex. Body of achenes 1–1.6 mm long and .95–1.25 mm wide, ovoid. Styles straight or somewhat bent dorsiventrally.

3. **Carex longii** Mackenzie, Bull. Torrey Bot. Club 49: 372–373. 1923. TYPE: Cold Spring, Cape May County, New Jersey, 24 July 1907. B. Long *s.n.* (HOLOTYPE: PH!).

Culms caespitose. Fertile culms (2) 3–12 dm tall; culm bases pale to brownish-black, 1.2–3.0 mm thick, aphyllopodic. Longest

leaf sheaths ⅓ to ½ as long as mature culms. Ligules prolonged, often somewhat loose. Leaves 2–4 to a fertile culm; broadest leaves 2–4 mm wide; upper blades 5–25 cm long. Inflorescences 1–4.5 cm long and composed of 3–10 usually aggregated, gynaecandrous spikes with appressed-ascending beaks. Lowest bracts scale-like to setaceous. Spikes 6–13 × 3.8–7 mm, obtuse to broadly acute at apex, rounded at base. Pistillate scales shorter and narrower than perigynia, often convex, obtuse or occasionally acute at apex with midrib ending below apex. Perigynia papery, green to drab brown at maturity, 3–4.5 × 1.6–2.6 mm, the body obovate with 4–7 raised nerves on ventral face and many nerves on dorsal face. Perigynium beaks ⅓ to ½ as long as body, gradually tapered from body, the wing reaching to apex. Body of achenes 1.3–1.7 mm long and .75–1 mm wide, oblong. Styles straight.

This species is referred to as *Carex albolutescens* by Gleason (1952), Radford et al. (1964), and Seymour (1969).

## ACKNOWLEDGMENTS

My thanks are given to herbarium curators for loan and use of collections under their care. Special gratitude is extended to C. S. Keener and A. A. Reznicek for their help and encouragement. Partial support for this work was received from the Taylor University Fund for Faculty Scholarship.

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## APPENDIX

## Representative specimens

*Carex albolutescens*

**Alabama**: Hale Co., Payne Lake Rec. Area, 30 April 1987, *Bryson 5579* (MICH). **Arkansas**: Hot Springs Co., Magnet Cove, 2 May 1937, *Demaree 14811* (MO). **Georgia**: Murray Co., floodplain of Conasauga River, 9 May 1969, *Bowers & Morton 43525* (NY, TENN). **Indiana**: Jackson Co., 5 mi. W of Freetown, 5 June 1940, *Deam 59606* (CU, IND). **Kentucky**: Bath Co., Olympian Springs, 9 June 1938, *Wharton 2524* (GH, MICH). **Louisiana**: East Baton Rouge Parish, Comite River, 22 April 1928, *Brown 1922* (MICH). **Maryland**: Prince Georges Co., Beltsville, 13 June 1943, *Hermann 10859* (NY). **Massachusetts**: Bristol Co., Dighton, 29 June 1961, *Seymour 19292* (MO). **Mississippi**: Itawamba Co., .8 mi. NE of Kirkville, 27 May 1986, *Bryson 4404* (MICH). **North Carolina**: Granville Co., 1.4 mi. E of Creedmoor, 16 June 1961, *Radford 43925* (NCU); Hertford Co., NE of Como, 30 May 1958, *Ahles & Duke 41661* (NCU, GA). **New Jersey**: Camden Co., Pensauken, 15 June 1918, *Long 19103* (GH). **New York**: Suffolk Co., Greenport, Long Island, 20 June 1916, *Chase 7389* (CU). **Ohio**: Columbiana Co., Tritton Marsh, Center Twp., 12 July 1989, *Bissell et al. 1989:197* (MICH). **Pennsylvania**: Chester Co., S of Nottingham, 22 June 1912, *Pennell 3752* (PAC). **South Carolina**: Clarendon Co., 2½ mi. SSW of Summerton, 20 April 1957, *Radford 21233* (NCU). **Tennessee**: Coffee Co., Tullahoma, 2 June 1938, *Svenson 8720* (BH, TENN); Franklin Co., Huntland, 29 May 1954, *Svenson 13090* (GH, TENN). **Texas**: Wood Co., E of Quitman, 12 May 1989, *S. & G. Jones & Powell 2778* (MICH). **Virginia**: Stafford Co., 3½ mi. E of Falmouth, 8 June 1940, *Hermann 10558* (CU, NY). **West Virginia**: Greenbrier Co., SW of Crawley, 12 July 1983, *Brant 291* (SIU, VPI).

*Carex festucacea*

**Ontario**: Essex Co., 7 km WSW of Kingsville, 19 June 1983, *Reznicek et al. 7171* (MICH). **Connecticut**: Fairfield Co., Norwalk, 19 June & 1 July 1941, *Eames 12066* (BH, IND, NCU). **Georgia**: Ben Hill Co., 16.3 mi. ENE of Fitzgerald, 27 April 1968, *Faircloth 5098* (GA, NCU). **Illinois**: Jackson Co., 2 mi. N of DeSoto, 20 May 1960, *Mohlenbrock & Dillard s.n.* (SIU); Randolph Co., Rock Castle Creek, 26 May 1970, *Evans 1057* (SIU); St. Clair Co., wet places, 31 May 1893, *Eggert s.n.* (BH, MO). **Indiana**: Knox Co., 2¾ mi. N of Bicknell, 7 June 1912, *Deam 10060* (IND); Laporte Co., 2 mi. S of South Wanatah, 29 May 1927, *Deam 44352* (IND). **Kansas**: Cowley Co., 7 mi. W of Winfield, 11 August 1966, *Koch 1837* (NCU).

**Massachusetts**: Hampshire Co., Hadley, 12 June 1980, *Ahles 87995c* (BH). **Mississippi**: Clay Co., 10 mi. SE of West Point, 16 May 1982, *Bryson 3292* (VPI). **Missouri**: Lincoln Co., T49N R2E S½ sec. 2, 1 June 1985, *Brant et al. 598* (MO). **New York**: Tompkins Co., Cayuga Heights, 9 June 1918, *Wiegand 9438* (MO). **North Carolina**: Orange Co., vic. of Chapel Hill, *Ashe s.n.* (CU, NCU). **Pennsylvania**: Berks Co., 1⅔ mi. E of Bernville, 24 May 1959, *Berkheimer 19125* (VPI); Centre Co., Ingleby, 30 May 1938, *Wahl 82* (NCU, PAC). **Tennessee**: Montgomery Co., 5 mi. SW of Clarksville, 7 May 1950, *Brown & Clebsch s.n.* (NCU). **Texas**: Franklin Co., .3 mi. S on Hwy. 115 from its jcn. w/ FM 3122, 12 May 1989, *S. & G. Jones & Powell 2800* (MICH). **Virginia**: Lunenberg Co., 12 mi. SE of Lunenburg, 3 June 1986, *Wieboldt 5992* (VPI); Sussex Co., 4½ mi. N of Sussex, 4 June 1986, *Wieboldt 6024* (VPI).

*Carex longii*

**Arkansas**: Saline Co., Benton, 16 May 1942, *Demaree 22969* (MO, NY). **Delaware**: Sussex Co., Rehoboth, 19 June 1926, *True 73* (GA). **Florida**: Lake Co., vic. of Eustis, 1–15 June 1894, *Nash s.n.* (CU, GH, MICH); Leon Co., betw. Tallahassee & Lake Bradford, 31 May 1955, *Godfrey 53340* (NY, NCU). **Georgia**: Chatham Co., SW of Savannah, 31 March 1929, *Miller & Maguire 271* (BH); Dougherty Co., 4 mi. S of Albany, 28 June 1947, *Thorne 4999* (CU, GH, GA); Glynn Co., S end of Jekyll Island, 3 September 1948, *Thorne & Muenscher 8873* (CU, GA). **Indiana**: Jasper Co., 2½ mi. SE of Tefft, 5 July 1937, *Deam 57961* (IND, MICH). **Louisiana**: Washington Parish, Sheridan, 13 May 1972, *Rogers 8045* (NCU). **Massachusetts**: Barnstable Co., Harwich, 20 July 1918, *Fernald s.n.* (CU, GH, IND, MICH, NCU, GA, TENN). **Michigan**: Kalamazoo Co., 2 mi. NW of Vicksburg, 9 July 1937, *Hermann 9007* (CU, MICH, NY). **Mississippi**: Harrison Co., Biloxi, 28 April 1898, *Tracy s.n.* (MICH, MO, NY); Lamar Co., Purvis, 17 May 1972, *Rogers 8106* (NCU, TENN). **New Jersey**: Middlesex Co., South Amboy, 8 July 1906, *Mackenzie 2171* (IND). **New York**: Nassau Co., NE of Hempstead, 23 June 1908, *Harper s.n.* (GH, NY). **North Carolina**: Pamlico Co., Janeiro, 5 July 1958, *Radford 36003* (NCU); Washington Co., 3 mi. E of Hoke, 15 June 1958, *Radford 35068* (GH). **Pennsylvania**: Lackawanna Co., E of Old Forge, 28 June 1946, *Glowenke 6906* (PAC). **Rhode Island**: Bristol Co., Bristol, 11 August 1961, *Seymour 19459* (MO); Washington Co., Westerly, 11 July 1913, *Woodward s.n.* (GH, PAC). **South Carolina**: Colleton Co., 8 mi. SE of Walterboro, 18 July 1927, *Wiegand & Manning 409* (CU, GH). **Texas**: Houston Co., 5 mi. W of Crockett, 26 May 1959, *Correll et al. 22366* (NY). **Virginia**: City of Virginia Beach, Sandbridge, 22 June 1971, *Uttal 8146* (VPI); Lancaster Co., 3 mi. W of Westland, 9 June 1940, *Hermann 10579* (CU, NY).